

That which is claimed:

1. A method for generating a directional sound environment, the method comprising:

5 providing a headgear unit having a plurality of microphones thereon;  
detecting a sound signal from the plurality of microphones;  
applying a transfer function to the sound signal to provide a transformed sound signal, the transformed sound signal providing an approximation of free field hearing sound at a subject's ear inside the headgear unit.

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2. The method of Claim 1, wherein the transfer function is based on an experimentally determined propagation effect from sound propagating to an opening of an ear canal and substantially omitting propagation interference from the headgear unit.

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3. The method of Claim 1, further comprising generating sound inside the headgear unit responsive to the transformed sound signal.

4. The method of Claim 1, wherein the headgear unit comprises a  
20 protective helmet.

5. The method of Claim 1, wherein the plurality of microphones are positioned at locations on the headgear unit, the locations being selected to provide sufficient sound information to provide an approximation of free field hearing sound.

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6. The method of Claim 1, wherein applying a transfer function further comprises reducing the amplitude of a portion of the sound signal if the amplitude is higher than a threshold level.

7. The method of Claim 1, wherein applying a transfer function further comprises canceling the amplitude of portions of sound signals.

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8. The method of Claim 1, wherein the headgear unit comprises a pinna positioned on an outer surface of the headgear unit.

9. The method of Claim 1, wherein the headgear unit is substantially sound-proof in a frequency range.

5 10. A method for generating a directional sound environment, the method comprising:

providing a plurality of headgear units, each headgear unit having a plurality of microphones thereon;

10 detecting a sound signal from the plurality of microphones on the plurality of headgear units;

applying a transfer function to the sound signal to provide a transformed sound signal, the transformed sound signal providing an approximation of free field hearing sound at a subject's ear inside at least one of the headgear units.

15 11. A device for generating a directional sound environment, the device comprising:

a headgear unit;

a pinna on an outer surface of the headgear unit;

20 one or more microphones, wherein at least one of the microphones is positioned adjacent the pinna; and

a speaker positioned in an interior of the headgear unit, wherein the microphone is configured to receive a sound signal and the speaker is configured to generate sound inside the headgear unit.

25 12. The device of Claim 11, wherein the device further comprises a processor configured to apply a transfer function to the received sound signal to provide a transformed sound signal, the transformed sound signal providing an approximation of free field hearing sound at a subject's ear inside the headgear unit.

30 13. The device of Claim 12, wherein the transfer function is based on an experimentally determined propagation effect from sound propagating to an opening of an ear canal and substantially omitting propagation interference from the headgear unit.

14. The device of Claim 12, wherein the plurality of microphones are positioned at locations on the headgear unit, the locations being selected to provide sufficient sound information to provide an approximation of free field hearing sound.

5 15. The device of Claim 12, wherein the processor is further configured to reduce an amplitude of a portion of the sound signal if the amplitude is higher than a threshold level.

10 16. The device of Claim 12, wherein the processor is further configured to cancel the amplitude of a portion of the sound signal.

17. The device of Claim 12, wherein the headgear unit comprises a helmet.

15 18. The device of Claim 11, wherein the headgear unit is substantially sound-proof in a frequency range.

19. A device for generating a directional sound environment, the device comprising:

20 a headgear unit having plurality of microphones thereon, the microphones configured to detect sound signals;

a processor in communication with the microphones configured to apply a transfer function to the sound signal to provide a transformed sound signal, the transformed sound signal providing an approximation of free field hearing sound at a subject's ear inside the headgear unit; and

25 a speaker positioned in an interior portion of the headgear unit configured to generate the transformed sound inside the headgear unit.

30 20. The device of Claim 19, wherein the transfer function is based on an experimentally determined propagation effect from sound propagating to an opening of an ear canal and substantially omitting propagation interference from the headgear unit.

21. The device of Claim 19, wherein the plurality of microphones are positioned at locations on the headgear unit, the locations being selected to provide sufficient sound information to provide the transformed sound.

5           22. The device of Claim 19, wherein the processor is further configured to reduce the amplitude of a portion of the transformed sound if the amplitude is higher than a threshold level.

10           23. The device of Claim 19, wherein the processor is further configured to cancel the amplitude of selected sound signals.

24. The device of Claim 19, wherein the headgear unit comprises a pinna positioned on an outer surface of the headgear unit.

15           25. The device of Claim 19, wherein the headgear unit comprises a helmet.

26. A method for preparing a directional sound environment, the method comprising:

20           providing a plurality of sound sources at a first set of locations and a plurality of sound receivers at a second set of locations, the second set of locations being positioned on a headgear unit;

              generating a first set of sounds at the plurality of sound sources;

              receiving sound signals at the plurality of sound receivers, the sound signals being a result of sound propagation from the sound sources to the sound receivers;

25           and

              identifying one or more of the received signals to provide an approximation of the first set of sounds.

27. The method of Claim 26, further comprising processing the received signals to provide a transfer function representing differences between the first set of sounds and the received signals.

28. The method of Claim 26, wherein the identifying one or more of the received signals comprises:

combining the received signals to provide a combined signal; and  
selecting one or more of the received signals selectively eliminating one or  
more of the received signals from a combined signal.

5           29.     The method of Claim 26, further comprising selecting locations from  
the second set of locations based on the identified one or more second set of sounds.

30.     The method of Claim 26, further comprising reducing the amplitude of  
a portion of the received signal if the amplitude is higher than a threshold level.

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31.     The method of Claim 26, further comprising canceling the amplitude  
of selected received signals.

32.     The method of Claim 26, further comprising determining a transfer  
15     function approximating sound proximate the headgear unit to reduce sound  
interference from the headgear unit.

33.     The method of Claim 26, further comprising identifying one or more of  
the second set of locations based on the identified received signals.

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34.     The method of Claim 26, wherein the headgear unit is substantially  
sound-proof in a frequency range.

35.     The method of Claim 26, further comprising providing one or more  
25     pinna on an outer surface of the headgear unit.

36.     The method of Claim 35, further comprising positioning at least sound  
receiver on the pinna.